## Least-squares regression lines and residual plots

Ex 3E, Question 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Day | 2 | 4 | 5 | 7 | 8 | 9 | 10 | 11 |
| Defective rate (%) | 15 | 10 | 12 | 4 | 9 | 7 | 3 | 4 |

Prior to inputting new data into your calculator, clear the calculator of any previous data by pressing:

* Ctrl N

Input the data into your calculator in the Lists & Spreadsheets page. Call column A “day” and column B “defective”.



To find the parameters for the **least-squares regression** equation, press:

* MENU
* 4: Statistics
* 1: Stat Calculations
* 3: Linear Regression (mx + b)

The X list will be the independent variable “day”, the Y List will be the dependent variable “defective”, and the 1st result column will be “c”.

All of the regression data will now be shown in Columns C and D.



**Residual**

Place the cursor in the **grey** cell in the next empty column to the right and press:

* Ctrl MENU
* 4: Variables
* 3: Link To
* Stat?.resid

Where the ? may be any number. If you did not press Ctrl N before you started you may get several different stat?.resid’s. If you choose the wrong one you will get a rubbish answer. Clear your calculator of all old data before you start each question.



The residuals are now shown in column E. To plot the residuals on paper you need to plot the residual against the independent variable, which is listed in column A (in our example “day”)

**If you are plotting the residual plot and regression line on paper**

You will need to calculate the predicted value of the dependent variable (ypred). Place your cursor in the next vacant title cell (the cell at the top of the screen with the letters in the top left of the cell) to the right and name the column. In our example you would name the column “defectpred”. Move the cursor down to the grey cell immediately beneath the title cell and press enter. The cell should now read “**defectpred=”** and a blinking cursor.

Press:

* d3\*a+d4 (assuming that column a contains the x values and that cell d3 contains the value for m and cell d4 contains the value for b.
* enter



The ypred values are now listed in column F. To plot the linear regression line you need to plot the scatterplot (x,y) or (day,defective)and **at least two** points from the linear regression line (x, ypred) or (day,defectpred).

Do **not** plot the residual and regression line on the same set of axes.

Make sure each plot has a title and that all of the axes are labelled, if you want to get all the available marks.

**If you are plotting the residual plot and the regression line on your calculator**

Press:

* HOME
* Data & Statistics

Move the cursor down to the x-axis and choose the independent variable (“day”).

Move the cursor to the y-axis and choose the dependent variable (“defective”).

Then, press:

* MENU
* 4: Analyse
* 6: Regression
* 1: Show Linear (mx + b)

And the regression line and regression equation appear on the screen.



Move the cursor back to the y-axis and choose stat?.resid and the residual plot appears on the screen.

